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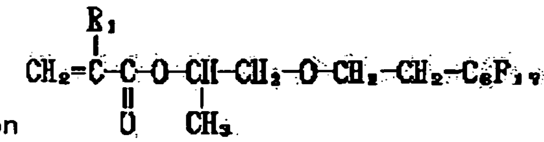
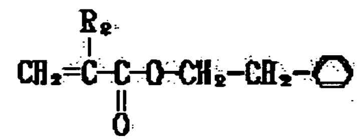
(54) INTRAOCULAR LENS AND MANUFACTURING PROCESS THEREFOR

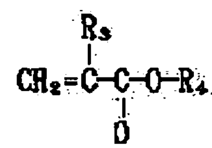
(57)Abstract:
PROBLEM TO BE SOLVED: To make it possible to manufacture unified-type soft intraocular lenses easy and efficient in production, by forming the optical section capable of functioning as an alternative lens of crystalline lens from copolymer whose bridged compound of a specific amount is used as monomer to some kinds of compounds expressed in terms of specific chemical formulae.



I



II



III

SOLUTION: This intraocular lens consists of an optical section capable of functioning as an alternative lens of crystalline lens and a support member to fix and hole this optical section to and at a given position inside the eye. In this case, the optical section is formed by copolymer derived from polymerizing 0.5-4wt.% of a bridged compound to the total weight of 5-20wt.% compound expressed in terms of chemical formula I, 20-60wt.% compound expressed in terms of chemical formula II and 30-50wt.% compound expressed in terms of chemical formula III. In these chemical formulae I-III, R1-R3 represent hydrogen atoms or any group substituting for alkyl group. R4 represents a group substituting either for a straight-chained or branched alkyl group whose number of carbons is above 4 and below 12, such as butyl group, pentyl group and the like.

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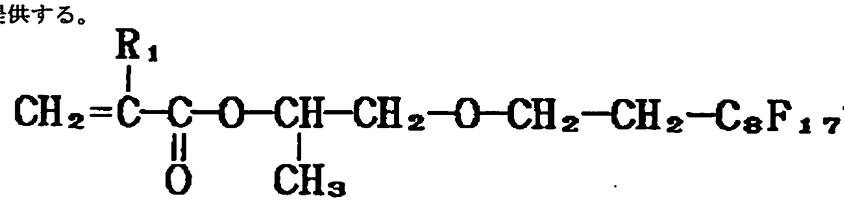
(54)【発明の名称】　眼内レンズ及びその製造方法

(57)【要約】　（修正有）
【課題】　簡便で、生産上効率のよい、一体型軟性眼内レンズの製造方法を提供する。

【解決手段】眼内レンズにおいて、水晶体の代替レンズとして機能する光学部を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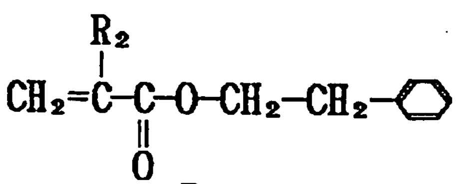
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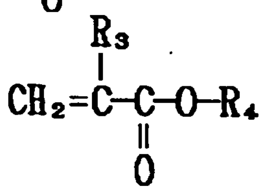
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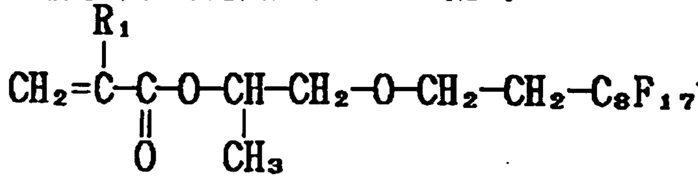
および架橋性化合物とを重合させて作成。

【特許請求の範囲】

【請求項１】　水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズであって、

上記光学部が、少なくとも、５～２０重量%の式

【化１】

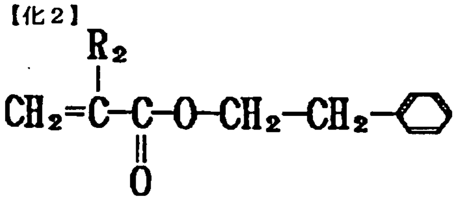


…(1)

（式中R1 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、

４０～６０重量%の式

【化２】

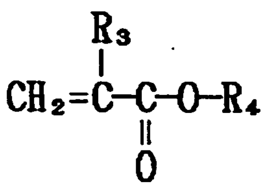


…(2)

（式中R2 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、

３０～５０重量%の式

【化３】



…(3)

（式中R3 は、水素原子又はアルキル基の置換基を表す、

R4 は、炭素数が４以上１２以下である直鎖又は分岐状のアルキル基の置換基を表す）で表される化合物と、

（１）～（３）式で表される化合物の総重量に対して

０．５～４重量%の架橋性化合物とをモノマーとする共重合体からなることを特徴とする眼内レンズ。

【請求項２】　上記光学部が、眼科手術中のレンズの挿入時に変形可能な軟性を有することを特徴とする請求項１に記載の軟性の眼内レンズ。

【請求項３】　上記光学部と上記上記支持部とを接合したことを特徴とする請求項１又は２に記載の一体型の軟性の眼内レンズ。

【請求項４】　上記光学部と上記上記支持部とを重合により接合したことを特徴とする請求項３に記載の一体型の眼内レンズ。

【請求項５】　水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズの製造方法であって、

上記支持部を形成させ得る重合可能な原料を重合して上記支持部の材料を形成する工程と、

この重合した支持部の材料を機械加工により穴をあける工程と、

この穴に上記光学部を形成させ得る重合可能な原料を注入する工程と、

注入した原料を重合して、上記光学部と上記支持部の一体型部材を形成する工程と、

この一体型部材を切削する切削工程と研磨する研磨工程とを有することを特徴とする眼内レンズの製造方法。

【請求項６】　水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズの製造方法であって、

上記支持部を形成させ得る重合可能な原料の中心部に棒状部材を挿入した状態で当該原料を重合して、重合後に上記棒状部材を引き抜くことにより穴のあいた上記支持部の材料を形成する工程と、

上記支持部の材料の穴に上記光学部を形成させ得る重合可能な原料を注入する工程と、

注入した原料を重合して、上記光学部と上記支持部の一体型部材を形成する工程と、

この一体型部材を切削する切削工程と研磨する研磨工程とを有することを特徴とする眼内レンズの製造方法。

【請求項７】　上記光学部を形成させ得る重合可能な原料が、少なくとも、５～２０重量%の（１）式（式中R1 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、

４０～６０重量%の（２）式（式中R2 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、

３０～５０重量%の（３）式（式中R3 は、水素原子又はアルキル基の置換基を表す、

R4 は、炭素数が４以上１２以下である直鎖又は分岐状のアルキル基の置換基を表す）で表される化合物と、

（１）～（３）式で表される化合物の総重量に対して

０．５～４重量%の架橋性化合物とを含むことを特徴とする請求項５又は６に記載の眼内レンズの製造方法。

【請求項８】　上記切削工程において、

冷却しながら、上記一体型部材を切削することを特徴とする請求項５～７の何れかに記載の眼内レンズの製造方法。

【請求項９】　上記研磨工程において、

冷却しながら、上記一体型部材を研磨することを特徴と

する請求項５～８の何れかに記載の眼内レンズの製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、眼内レンズ及びその製造方法に関し、特に眼内挿入時に光学部を折り曲げて小切開創からの挿入可能な一体型軟性眼内レンズ及びその製造方法に適用し得るものである。

【０００２】

【従来の技術】白内障等によって視力が低下した場合に、機能を損なわれた水晶体の代わりに眼内レンズ（ＩｎｔｒａＯｃｕｌａｒ　Ｌｅｎｓ：ＩＯＬ）の移植する手術を行うことにより、患者の視力の回復が図られている。

【０００３】眼内レンズは、白内障により除去された水晶体の代替レンズとして機能する光学部とその光学部を嚢内での中心位置に固定、保持するための細長いフィラメント状の支持部とから構成される。

【０００４】従来からの光学部の材質としては、硬質の材料であるＰＭＭＡ（ポリメチルメタクリレート）が主に使用されてきた。ＰＭＭＡが眼内レンズの材料として用いられる理由は、透明性、体内での安定性に優れている為であり、しかも機械加工性もよいことから精巧なレンズを安定供給できる点にあった。

【０００５】そして、このＰＭＭＡ製光学部を固定、保持するための支持部としては、ＰＭＭＡ、ＰＰ（ポリプロピレン）等のモノフィラメントが使用されてきた。

【０００６】光学部と支持部との結合は、光学部に支持部を取り付けるための小孔を予め設けておき、光学部を完成させた後に支持部を小孔に挿入し、ステーキングやレーザー等により支持部を光学部に固定させる方法、あるいは、ＰＭＭＡ製の一体型（ワンピース）形状を作成する方法等がある。

【０００７】一方、近年、超音波乳化吸引術等の普及に伴い、術後乱視と手術侵襲の軽減を目的とした小切開創からの挿入可能な眼内レンズが開発されている。すなわち、、光学部材質に軟性材料を用いることにより、光学部折り曲げて小切開創からの挿入を可能にした軟性眼内レンズである。

【０００８】しかし、軟性材料は機械加工、特に従来のＰＭＭＡのように切削加工及び研磨が困難なために、光学部形成材料であるモノマー、プレモノマー及びオリゴマーを型内で重合するキャストモールド法によって光学部を作成する必要がある。また、支持部の取り付け方法も従来のように機械的に小孔を設けるということが困難なために、従来とは異なる方法を用いなければならない。

【０００９】このような軟性眼内レンズの製造方法として、特開昭６２－１４２５５８号及び特開昭６２－１５２４５０号には、支持部を構成するフィラメントの末端部分を球根状などの機械的な係合部を形成するような形状へと恒久的に変形するか、あるいはフィラメントの末端部に機械的な係合部を形成する別のフィラメントを接合することによって、得られた支持部の末端部分を取り囲んで光学部材を型成形することによって離脱しにくい支持部を有する眼内レンズの製造方法が開示されている。

【００１０】また、特開平４－２９２６０９号には、型内で軟性光学材料を重合した後に、型ごと冷却することによって軟性材料を硬くして支持部を挿入するための小孔、アンカーフィラメントを挿入するための小孔を機械的に設ける。次に、軟性光学部に設けられた支持部挿入孔に支持部を挿入し、アンカーフィラメント挿入孔にも支持部と同材質のフィラメントを挿入し、支持部とアンカーフィラメントとの交点にレーザービームを照射して、溶融融着させる。レーザービームをこの挿入孔そって照射して完成させるという眼内レンズの製造方法が開示されている。

【００１１】また、特開平４－２９５３５３号には、以下に示すような眼内レンズの製造方法が開示されている。すなわち、折りたたみ可能な光学部材としてポリ（メタクリル酸ヒドロキシエチル）もしくはＰＨＥＭＡ又はその共重合体等を用い、重合してロッドを作成する。そのロッド管状を型内に設置して、該ロッドの周囲に支持部材となるＰＭＭＡ等の重合可能な液体溶液の円筒状層を形成する。その後、重合可能な液体溶液を重合させる。次いで、この重合したディスクを切り出し、切削加工を行い、眼内レンズを作成する。その後、レンズを水和（含水）させることで折りたたみ可能とする。

【００１２】特開平１－１５８９４９号には、以下に示すような眼内レンズの製造方法が開示されている。すなわち、架橋済アクリル樹脂材料で平板等を作成し、その平板をホルダー上に乗せ、低温で旋盤工作でディスクに切断し、切削することで軟性光学部を得る。得られた光学部に支持部孔を設けてスリーピース型眼内レンズを得る。若しくは、上記の作成した平板より、レンズ形状を切り出して折りたたみ可能な光学部及び光学部材と同材質である軟質性の支持部を有した眼内レンズを得る。

【００１３】さらに、特開平５－２６９１９１号には、以下に示すような眼内レンズの製造方法が開示されている。すなわち、５ｍｍφ、高さ２０ｍｍの光学部材を重合し、その後内径１５ｍｍ、高さ２０ｍｍの円筒状中央に設置して、その周辺部で支持部材となる溶液を重合させる。重合後、切削により眼内レンズ形状を作成し、アルコール中に約４８時間浸漬させ光学部をエステル化反応により軟質にさせる。

【００１４】

【発明が解決しようとする課題】上述のような眼内レンズの製造方法が種々開示されているが、これらの製造方法はいずれも煩雑、複雑な操作を伴うか、もしくは生産

上効率が悪い。

【００１５】すなわち、特開昭６２－１４２５５８号及び特開昭６２－１５２４５０号に開示されている眼内レンズの製造方法では、支持部となる合成樹脂フィラメントを複雑な形状に加工しなければならない。支持部となるフィラメントは径が０．１５ｍｍ程度のもので、この末端部分を全て同じ形状に熱溶融に加工するには非常に煩雑で微細な処理を要する工程を設けなければならない。支持部は、眼内で保持、固定するために適する形状を有する必要があり、その形状を熱成形等により精巧に作成される必要がある。つまり、この精巧に作成された支持部を取り囲んで型内で軟性光学材料を製造する場合には支持部は再度加熱及び加圧工程を経る必要があり、眼内レンズの形状、寸法が変わってしまう可能性がある。

【００１６】また、特開平４－２９２６０９号における製造方法では、材料を冷却して支持部挿入孔とその孔に交差するアンカーフィラメント挿入孔の２つの孔開け操作が必要であり、その孔に支持部とアンカーフィラメントを挿入し、支持部の融着と孔のフィラメントによる充填をレーザービームを繰り返し照射することで達成しなければならず、かなり煩雑な操作を必要とする。

【００１７】また、特開平４－２９５３５３号においては、光学部にＨＥＭＡを主成分とする素材を用いており、レンズの切削時には硬質であるが切削後に水和（含水）させることで軟質性とする。ＨＥＭＡは、ロット間において吸水率に相違がある。従って、眼内レンズにおいては、一定のパワーを維持することは困難である。さらに、手術時に眼内レンズを含水させるにはかなりの時間がかかってしまう。また、眼内レンズにあらかじめ含水させた場合は、眼内レンズの滅菌状態を維持することが困難になる。

【００１８】特開平１－１５８９４９号においては、支持部材質が光学部材質と同材質であるため、支持部は軟質になる。従来の眼内レンズの支持部径は約０．１～０．２ｍｍ程度であるので、支持部はかなり柔軟になってしまう。したがって、支持部角度の維持も困難であり、嚢内での光学部の位置安定性はかなり不安定であると考えられる。

【００１９】さらに、特開平５－２６９１９１号においては、支持部材がアルコールと反応性を有するものは使用できない。また、光学部材と支持部材とを重合し、精密な切削研磨加工を行って眼内レンズ形状を作成した後、光学部に化学的反応を加えることにより光学部の形状（曲率の変化、厚さ、光学径等）が変化してしまう可能性があり、加工時の支持部角度（アングル）を維持することも困難である。

【００２０】本発明は上記問題点を解決するためになされたものであり、簡便で、生産上効率のよい、一体型軟性眼内レンズの製造方法を提供することを目的とする。

【００２１】

【課題を解決するための手段】請求項１の発明は、水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズであって、上記光学部が、少なくとも、５～２０重量％の（１）式（式中R1 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、４０～６０重量％の（２）式（式中R2 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、３０～５０重量％の（３）式（式中R3 は、水素原子又はアルキル基の置換基を表す、R4 は、炭素数が４以上１２以下である直鎖又は分岐状のアルキル基の置換基を表す）で表される化合物と、（１）～（３）式で表される化合物の総重量に対して０．５～４重量％の架橋性化合物とをモノマーとする共重合体からなることを特徴とする。

【００２２】請求項２の発明は、請求項１に記載の眼内レンズにおいて、上記光学部が、眼科手術中のレンズの挿入時に変形可能な軟性を有することを特徴とする。

【００２３】請求項３の発明は、請求項１又は２に記載の軟性の眼内レンズにおいて、上記光学部と上記上記支持部とを一体型に接合したことを特徴とする。

【００２４】請求項４の発明は、請求項３に記載の一体型の眼内レンズにおいて、上記光学部と上記上記支持部とを重合により接合したことを特徴とする。

【００２５】請求項５の発明は、水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズの製造方法であって、上記支持部を形成させ得る重合可能な原料を重合して上記支持部の材料を形成する工程と、この重合した支持部の材料を機械加工により穴をあける工程と、この穴に上記光学部を形成させ得る重合可能な原料を注入する工程と、注入した原料を重合して、上記光学部と上記支持部の一体型部材を形成する工程と、この一体型部材を切削する切削工程と研磨する研磨工程とを有することを特徴とする。

【００２６】請求項６の発明は、水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる眼内レンズの製造方法であって、上記支持部を形成させ得る重合可能な原料の中心部に棒状部材を挿入した状態で当該原料を重合して、重合後に上記棒状部材を引き抜くことにより穴のあいた上記支持部の材料を形成する工程と、上記支持部の材料の穴に上記光学部を形成させ得る重合可能な原料を注入する工程と、注入した原料を重合して、上記光学部と上記支持部の一体型部材を形成する工程と、この一体型部材を切削する切削工程と研磨する研磨工程とを有することを特徴とする。

【００２７】請求項７の発明は、請求項５又は６に記載の眼内レンズの製造方法において、上記光学部を形成させ得る重合可能な原料が、少なくとも、５～２０重量％

の（1）式（式中R1 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、40～60重量%の（2）式（式中R2 は、水素原子又はアルキル基の置換基を表す）で表される化合物と、30～50重量%の（3）式（式中R3 は、水素原子又はアルキル基の置換基を表す、R4 は、炭素数が4以上12以下である直鎖又は分岐状のアルキル基の置換基を表す）で表される化合物と、（1）～（3）式で表される化合物の総重量に対して0．5～4重量%の架橋性化合物とを含むことを特徴とする。

【0028】請求項8の発明は、請求項5～7の何れかに記載の眼内レンズの製造方法の上記切削工程において、冷却しながら、上記一体型部材を切削することを特徴とする。

【0029】請求項9の発明は、請求項5～8の何れかに記載の眼内レンズの製造方法の上記研磨工程において、冷却しながら、上記一体型部材を研磨することを特徴とする。

【0030】（1）式で表される化合物は、眼内レンズ材料の表面粘着性を低減させ、眼内レンズに適度の時間（20～60s）で元の形状に回復し安定化する機能を付加させるための重要な成分である。

【0031】（2）式で表される化合物は、眼内レンズ材料に高い屈折率を与えるための必須の成分である。

【0032】（3）式で表される化合物は、眼内レンズに柔軟性を与えるための必須の成分である。

【0033】架橋性化合物は、レンズの変形の防止及び機械的強度向上のための必須の成分である。

【0034】また、本発明の眼内レンズの製造方法では、冷却しながら一体型部材を切削して、冷却しながら一体型部材を研磨することによって、光学部を水和（含水）あるいはエステル化反応等の工程が不要になる。したがって、支持部角度（アングル）を維持することも可能になり、硬質で強度のある支持部を有する眼内レンズを得ることが可能になる。

【0035】さらに、冷却しながら一体型部材を切削して、冷却しながら一体型部材を研磨することによって、従来の一体型眼内レンズと同様の方法で一体型軟性眼内レンズを製造することが可能になる。

【0036】

【発明の実施の形態】以下、本発明による眼内レンズ及びその製造方法の実施の形態を図面を参照しながら詳細に説明する。

【0037】本発明に係る眼内レンズは、水晶体の代替レンズとして機能する光学部と、この光学部を眼内の所定の位置に固定、保持するための支持部とからなる。

【0038】本発明の特徴は、この光学部を、少なくとも、5～20重量%の（1）式で表される化合物と、40～60重量%の（2）式で表される化合物と、30～50重量%の（3）式で表される化合物と、（1）～（3）式で表される化合物の総重量に対して0．5～4重量%の架橋性化合物とを重合して作成するところにある。

【0039】なお、（1）式中のR1 は、水素原子又は、メチル基、エチル基、ブチル基、プロピル基等のアルキル基の何れかの置換基を表す。

【0040】また、（2）式中のR2 は、水素原子又は、メチル基、エチル基、ブチル基、プロピル基等のアルキル基の何れかの置換基を表す。

【0041】同様に、（3）式中のR3 は、水素原子又は、メチル基、エチル基、ブチル基、プロピル基等のアルキル基の何れかの置換基を表し、R4 は、ブチル基、ペンチル基等の炭素数が4以上12以下である直鎖又は分岐状のアルキル基の置換基を表す。

【0042】なお、本発明では、上記化合物に加えて、紫外線吸収能を有する化合物や眼内レンズを着色するための重合性色素等を光学部に係るモノマーとして用いることができる。

【0043】このような（1）～（3）式で表される化合物及び架橋性化合物を重合して、一体型軟性眼内レンズを製造する方法を以下に説明する。

【0044】まず、本実施の形態では、図1、2に示すようなPMMAのボタン材を支持部の材料とする。

【0045】図1はPMMA材に軟性光学部作成用の穴をあけたボタンの側面図であり、図2は、同正面図である。PMMAボタン材2，3は径15mmφ、高さ10mmであり、軟性光学部作成用の穴1，4は径7mmφ、深さ4mmである。

【0046】このように眼内レンズに一般的に使用されているPMMAの円筒形状のボタン2，3にPMMA材に軟性光学部作成用の穴1，4をあける。

【0047】この穴1，4に、少なくとも、5～20重量%の（1）式で表される化合物と、40～60重量%の（2）式で表される化合物と、30～50重量%の（3）式で表される化合物と、、（1）～（3）式で表される化合物の総重量に対して0．5～4重量%の架橋性化合物とを注入して、重合させる。

【0048】重合後、ボタンを3mmにカットして冷却しながら、ミーニングマシーンによって光学部と支持部とが一体（ワンピース）形状をなした眼内レンズを作成する。

【0049】その後、低温下（冷却しながら）においてバレル研磨することにより、所望の一体型軟性眼内レンズを作成する。

【0050】（実施例1）図1，2に示すPMMAのボタン材に7mmφの穴をあけ、軟性光学部の材料として下記に示す配合のモノマーを使用した。

【0051】

重量部（重量%）

フェニルエチルメタクリレート	（ＰＥＭＡ）	４９
ｎ－ブチルアクリレート	（ＢＡ）	４２
パーフロロオクチルエチルオキシプロピレンメタクリレート	（ＢＲＭ）	９
エチレングリコールジメタクリレート	（ＥＤＭＡ）	３
アゾイソブチロニトリル	（ＡＩＢＮ）	０．３

上記の混合物を、ボタンの穴１，４に注入して、窒素圧２．０Ｋｇ／ｃｍ^2 、温度６０℃で２時間加圧重合を行った。その後８０℃・２時間、次いで１００℃と昇温させた。

【００５２】このようにして、作成した軟性光学部材がＰＭＭＡボタンの中心部にあるボタンを図３、４に示す。図３はこのようにして作成したボタンを示す側面図であり、図４は、同正面図である。

【００５３】その後、図５のボタンの側面図に示した位置２２に沿って３mm厚のボタンを切り出して、切り出したボタンに－５℃の冷気を吹きかけながら光学面を切削した。次いで、再度冷気を吹きかけながら、この切り出したボタンを図６の太線１４部分をミーニングマシーンにより切り出し、一体型眼内レンズ形状を得た。

【００５４】得られたレンズを－５℃の恒温層中でバレル研磨を３日間行い、一体型軟性眼内レンズを得た。図７はこのようにして作成した眼内レンズを示す正面図であり、図８は、同側面図である。

【００５５】（実施例２）本実施例は、ボタン材に実施例１とは異なる形状の穴をあけて、このボタンを用いて眼内レンズを製造したときの例を示すものである。

【００５６】図１，２に示すＰＭＭＡのボタン材に７ｍｍφの穴をあけ、軟性光学部の材料として実施例１と同様のモノマーを使用した。

【００５７】まず、ボタン材を１４０℃のプレス板内で加熱して穴の形状を作成するために、冶具をボタン上に載せ、４Ｋｇ／ｃｍ^2 の加重を加えてボタンのプレスを行った。

【００５８】このようにして、作成したボタンを図９，１０示す。図９はこのようにして作成したボタンを示す側面図であり、図１０は、同正面図である。ボタン材２２，２３は径１５mmφ、高さ１０mmであり、穴２１，２４は径７mmφ、深さ４mmである。

【００５９】作成した穴２１，２４へ実施例１と同様の組成の混合物を注入して実施例１と同条件で重合を行った（窒素圧２．０Ｋｇ／ｃｍ^2 、温度６０℃で２時間加圧重合を行った。その後８０℃・２時間、次いで１００℃と昇温させた。）さらに、実施例１と同様の切削・研磨処理を行うことによって、一体型軟性眼内レンズを得た。

【００６０】本実施例に用いた図９，１０のボタンの特徴は、穴２１，２４に突部を設けているところにある。この突部を有する穴２１，２４にモノマーの混合物を注入して、重合させて、図１１の太線２７の示すように一体型眼内レンズをミーニングマシーンによって切り抜くことにより、光学部と支持部との接合部分に強度を持たせることができる。

【００６１】本実施例で得られた眼内レンズを図１２，１３に示す。図１２は作成した眼内レンズを示す正面図であり、図１３は、同側面図である。

【００６２】（比較例１）本比較例は、光学面の切削及びミーニングマシーンによる切り出しを行う際に冷却しかなったこと以外は、実施例１と同様の処理を行って、一体型眼内レンズを作成したときの例である。

【００６３】図１，２に示すＰＭＭＡのボタン材に７ｍｍφの穴をあけ、軟性光学部の材料として実施例１と同様の組成の混合物をを、ボタンの穴１，４に注入して、窒素圧２．０Ｋｇ／ｃｍ^2 、温度６０℃で２時間加圧重合を行った。その後８０℃・２時間、次いで１００℃と昇温させた。

【００６４】その後、３mm厚のボタンを切り出して、冷却せずに光学面を切削した。次いで、冷却せずに、この切り出したボタンをミーニングマシーンにより切り出し、一体型眼内レンズ形状を得た。

【００６５】得られたレンズを－５℃の恒温層中でバレル研磨を３日間行い、一体型軟性眼内レンズを得た。

【００６６】このようにして得られた一体型軟性眼内レンズは、軟性光学面が白化してしまって、光学機能を持たないものになってしまった。

【００６７】（比較例２）本比較例は、ボタン材を実施例２と同様にプレスによる成形を行って図９，１０示すように穴２１，２４をあけて、この穴２１，２４にＨＥＭＡを注入して重合して、含水処理を行った場合の例である。

【００６８】まず、ボタン材を１４０℃のプレス板内で加熱して穴の形状を作成するために、冶具をボタン上に載せ、４Ｋｇ／ｃｍ^2 の加重を加えてボタンのプレスを行った。

【００６９】作成した穴２１，２４へＨＥＭＡを注入して重合を行った。

【００７０】その後、ボタンを切り出して、冷却せずに光学面を切削した。次いで、冷却せずに、この切り出したボタンをミーニングマシーンにより切り出し、一体型眼内レンズ形状を得た。本比較例では、後述するように含水処理を行うために、冷却を行わなかった。次いで、得られたレンズにバレル研磨を３日間行い、一体型眼内レンズを得た。このとき作成した一体型眼内レンズの支持部角度は１０°であった。

【００７１】さらに、得られた眼内レンズを３日間蒸留水中に浸漬させることにより、光学部部分を含水させた。含水後の一体型眼内レンズの支持部角度は５～６゜程度であり、含水前のものからかなり変化していた。

【００７２】以上の実施例１，２、比較例１，２で作成した眼内レンズについて、光学部と支持部との接合強度を引っ張り試験により比較した。その試験結果を以下に示す。

【００７３】

	引っ張り強度（g）
実施例１	約１４０
実施例２	約１７０
比較例１	約３０
比較例２	約５５

本発明は、上記の実施の形態のものに限定されるものでなく、種々の変形を許容するものである。

【００７４】なお、本発明の眼内レンズの製造方法では、穴の形状は、図１４，１５に示すような穴の形状でもよく、図示しない他の穴の形状でもよい。また、様々な形状でボタンを貫通させるようにしてもよい。同様に、穴の径も任意に定めてもよい。図１４はＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの１例を示す側面図であり、図１５は、同正面図である。ＰＭＭＡボタン材３５，３８は径１５ｍｍφ、高さ１０ｍｍであり、軟性光学部作成用の穴３７は径７ｍｍφ、深さ４ｍｍである。

【００７５】ボタンの穴はフライス板等によってあけることができるが、あけたい穴の形状の冶具を作成してプレス機により穴をあけるほうが複雑な穴の形状も容易に作成できる。また、ボタン材もプレス（延伸）されることで、引っ張り強度が増し、支持部となる部分の強度を増すことができる。

【００７６】また、ボタンを原料から重合するときに、原料の中心部にテフロン棒等を挿入しておいて、重合終了後にテフロン棒等を引き抜いて中心部に穴のあいたボタンを作成してもよい。

【００７７】また、本発明に係るボタン材には、メチルメタクリレート、メチルメタクリレートの共重合体、エチルメタクリレート、ブチルメタクリレート等のアクリル系樹脂及びそれらを着色したもの使用することができる。

【００７８】さらに，本発明に係る光学部と支持部の材料は、実施例に示した以外のものでもよく、低含水率（冷却しながら切削可能）のもので、重合によって光学部と支持部とが結合可能なものであれば、他の材質を用いてもよい。

【００７９】

【発明の効果】以上説明したように本発明によれば、少なくとも、５～２０重量%の（１）式で表される化合物と、４０～６０重量%の（２）式で表される化合物と、３０～５０重量%の式で表される化合物と、（１）～（３）式で表される化合物の総重量に対して０．５～４重量%の架橋性化合物とを重合することによって光学部の材質を作成するようにしたので、眼内レンズ加工後に含水あるいはエステル化反応の工程を設ける必要が無くなり、簡便に且つ生産上効率よく眼内レンズをの製造することができる。

【図面の簡単な説明】

【図１】実施例１に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの側面図である。

【図２】実施例１に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの正面図である。

【図３】実施例１に係る軟性素材のボタンの側面図である。

【図４】実施例１に係る軟性素材のボタンの正面図である。

【図５】実施例１に係る軟性素材のボタンを３ｍｍに切り出す位置を示した側面図である。

【図６】実施例１に係るミーニングマシーンによる一体型眼内レンズの切り出し位置を示したボタンの正面図である。

【図７】実施例１で作成した眼内レンズの正面図である。

【図８】実施例１で作成した眼内レンズの側面図である。

【図９】実施例２に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの側面図である。

【図１０】実施例２に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの正面図である。

【図１１】実施例２に係るミーニングマシーンによる一体型眼内レンズの切り出し位置を示したボタンの正面図である。

【図１２】実施例２で作成した眼内レンズの正面図である。

【図１３】実施例２で作成した眼内レンズの側面図である。

【図１４】実施の形態に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの側面図である。

【図１５】実施の形態に係るＰＭＭＡ材に軟性光学部作成用の穴をあけたボタンの正面図である。

【符号の説明】

１，４，１３，２１，２４，２６，３４，３６，３７ 穴

２，３，１３，２２，２３，２５，３５，３８ ＰＭＭＡボタン材

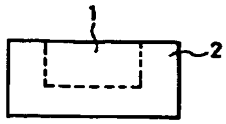
５，７，９　ボタンの軟性光学部素材部分

６，８，１１　ボタンの支持部材部分

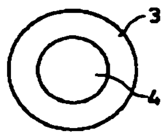
１５，１８，２８，３１　光学部

１６，１７，１９，２０，２９，３０，３２，３３　支持部

【図１】



【図２】



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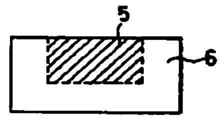

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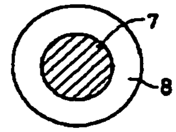

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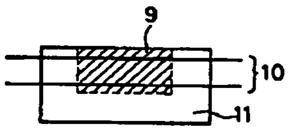

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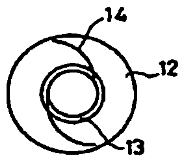

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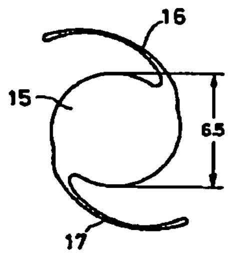

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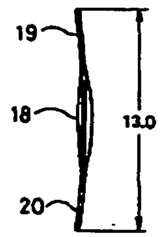
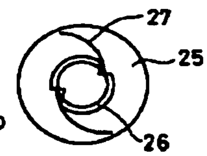


【図１１】



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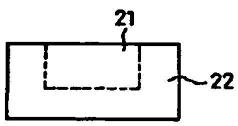
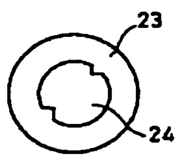
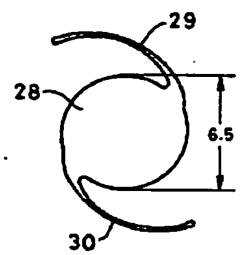


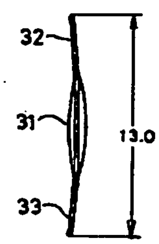
【図１０】



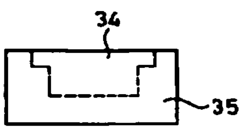
【図１２】



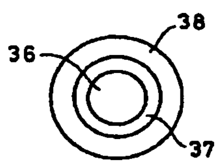
【図１３】



【図１４】



【図１５】



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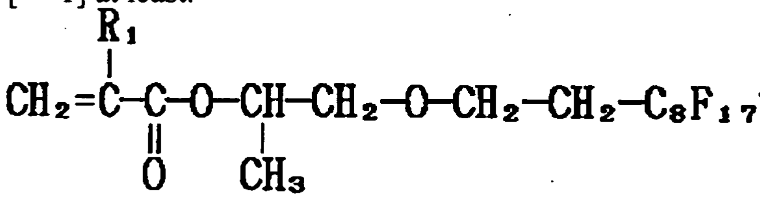
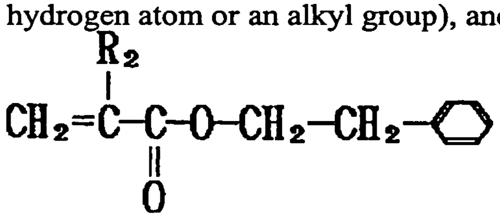
CLAIMS

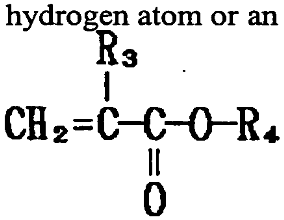
[Claim(s)]
[Claim 1] It is the intraocular implant which consists of an optical department which functions as an alternative lens of a lens, and a supporter for fixing and holding this optical department to the position in an eye, and the above-mentioned optical department is 5 - 20% of the weight of a formula [** 1] at least.


…(1)

They are the compound expressed with (the inside R1 of a formula expresses the substituent of a hydrogen atom or an alkyl group), and 40 - 60% of the weight of a formula [** 2].


…(2)

They are the compound expressed with (the inside R2 of a formula expresses the substituent of a hydrogen atom or an alkyl group), and 30 - 50% of the weight of a formula [** 3].


…(3)

It is the intraocular implant characterized by consisting of a copolymer which makes a monomer 0.5 - 4% of the weight of a cross-linking compound to the AUW of the compound expressed with (a carbon number expresses or more 4 substituent of the alkyl group of the straight chain it is [straight chain] 12 or less, or the letter of branching as for the inside R3 of a formula, as for R4 showing the substituent of a hydrogen atom or an alkyl group), and the compound expressed with (1) - (3) type.
[Claim 2] The intraocular implant of the elasticity according to claim 1 characterized by the above-mentioned optical department having deformable elasticity at the time of insertion of the lens under ophthalmology operation.
[Claim 3] The intraocular implant of the elasticity of one apparatus according to claim 1 or 2 characterized by joining the above-mentioned optical department and the above-mentioned above-mentioned supporter.
[Claim 4] The intraocular implant of one apparatus according to claim 3 characterized by joining the above-mentioned optical department and the above-mentioned above-mentioned supporter by the

polymerization.
[Claim 5] The optical department which functions as an alternative lens of a lens, and this optical department are fixed to the position in an eye. The process which carries out the polymerization of the raw material in which it is the manufacture approach of an intraocular implant which consists of a supporter for holding, and the above-mentioned supporter may be made to form, and in which a polymerization is possible, and forms the ingredient of the above-mentioned supporter, The process which makes a hole for the ingredient of this supporter that carried out the polymerization by machining, and the process which pours in the raw material which may make the above-mentioned optical department form in this hole, and in which a polymerization is possible, The manufacture approach of the intraocular implant which carries out the polymerization of the poured-in raw material, and is characterized by having the process which forms the one apparatus member of the above-mentioned optical department and the above-mentioned supporter, and the cut process which cuts this one apparatus member and the polish process to grind.
[Claim 6] The optical department which functions as an alternative lens of a lens, and this optical department are fixed to the position in an eye. Are the manufacture approach of an intraocular implant which consists of a supporter for holding, and where a cylindrical member is inserted in the core of the raw material in which a polymerization is possible in which the above-mentioned supporter may be made to form, the polymerization of the raw material concerned is carried out. The process which forms the ingredient of the above-mentioned supporter with which the hole opened by drawing out the above-mentioned cylindrical member after a polymerization, The process which pours in the raw material which may make the above-mentioned optical department form in the hole of the ingredient of the above-mentioned supporter, and in which a polymerization is possible, The manufacture approach of the intraocular implant which carries out the polymerization of the poured-in raw material, and is characterized by having the process which forms the one apparatus member of the above-mentioned optical department and the above-mentioned supporter, and the cut process which cuts this one apparatus member and the polish process to grind.
[Claim 7] The raw material in which the above-mentioned optical department may be made to form and in which a polymerization is possible is 5 - 20% of the weight of (1) type (the inside R1 of a formula) at least. the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 40 - 60% of the weight of (2) types (the inside R2 of a formula) the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 30 - 50% of the weight of (3) types (the inside R3 of a formula) R4 showing the substituent of a hydrogen atom or an alkyl group the substituent of the alkyl group of the straight chain whose carbon number is 12 or less [4 or more], or the letter of branching -- expressing -- the manufacture approach of the intraocular implant according to claim 5 or 6 characterized by including 0.5 - 4% of the weight of a cross-linking compound to the AUW of the compound expressed and the compound expressed with (1) - (3) type.
[Claim 8] The manufacture approach of an intraocular implant given in any of claims 5-7 characterized by cutting a up Norikazu form member in the above-mentioned cut process while cooling they are.
[Claim 9] The manufacture approach of an intraocular implant given in any of claims 5-8 characterized by grinding a up Norikazu form member in the above-mentioned polish process while cooling they are.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About an intraocular implant and its manufacture approach, especially this invention bends an optical department at the time of eye interpolation close, and can apply it to the one apparatus elasticity intraocular implant which can be inserted from a small incision, and its manufacture approach.
[0002]
[Description of the Prior Art] When eyesight declines by a cataract etc., recovery of a patient's eyesight is achieved by conducting the operation which an intraocular implant (IntraOcular Lens:IOL) transplants instead of the lens which had the function spoiled.
[0003] An intraocular implant consists of supporters of the shape of a long and slender filament for fixing and holding the optical department which functions as an alternative lens of the lens removed by the cataract, and its optical department to the center position within a sac.
[0004] As construction material of the optical department from the former, PMMA (polymethylmethacrylate) which is a hard ingredient has mainly been used. The reason PMMA is used as an ingredient of an intraocular implant is because it excels in transparency and the stability in the inside of the body, and, moreover, machinability also suited its point which can supply an elaborate lens adequately from a good thing.
[0005] And monofilaments, such as PMMA and PP (polypropylene), have been used as a supporter for fixing and holding this optical department made from PMMA.
[0006] Association with an optical department and a supporter prepares the stoma for attaching a supporter in the optical department beforehand, after it completes an optical department, it inserts a supporter in a stoma, and it has a method of making a supporter fix to an optical department with staking, laser, etc., or the approach of creating the one apparatus (dress) configuration made from PMMA.
[0007] On the other hand, the intraocular implant which can be inserted from the small incision aiming at relief of the postoperative astigmatism and operation invasing is developed with the spread of ultrasonic emulsification aspiration etc. in recent years. That is, it is the elasticity intraocular implant which enabled insertion from an optical department bending **** incision by using an elasticity ingredient for the quality of an optical member.
[0008] However, an elasticity ingredient needs to create an optical department like machining, especially conventional PMMA by the cast mould method which carries out the polymerization of the monomer, the pre monomer, and oligomer which are an optical department formation ingredient since cutting and polish are difficult within a mold. Moreover, since the mounting arrangement of a supporter is also difficult to prepare a stoma mechanically like before, a different approach from the former must be used.
[0009] As the manufacture approach of such an elasticity intraocular implant, to JP,62-142558,A and JP,62-152450,A [whether a part for the end of the filament which constitutes a supporter is everlastingly transformed into a configuration which forms the mechanical engagement sections, such as the shape of a bulb, and] Or by joining another filament which forms the mechanical engagement section in the end of a filament, the manufacture approach of the intraocular implant which has the supporter from which it is hard to secede by surrounding a part for the end of the

obtained supporter and carrying out die forming of the optical member is indicated.
[0010] Moreover, after carrying out the polymerization of the elasticity optical material within a mold, the stoma for inserting the stoma for hardening an elasticity ingredient and inserting a supporter and a support filament is mechanically prepared in JP,4-292609,A by cooling the whole mold. Next, a supporter is inserted in the supporter insertion hole prepared in the elasticity optical department, a supporter and the filament of this construction material are inserted also in a support filament insertion hole, and the intersection of a supporter and a support filament is irradiated and is made to carry out melting welding of the laser beam. The manufacture approach of the intraocular implant of irradiating a laser beam as this insertion ****, and making it complete is indicated.
[0011] Moreover, the manufacture approach of an intraocular implant as shown below is indicated by JP,4-295353,A. That is, using Pori (methacrylic-acid hydroxyethyl), PHEMA, or its copolymer as an optical member which can fold, a polymerization is carried out and a rod is created. The shape of the rod tubing is installed in a mold, and the cylindrical layer of the liquid solution in which polymerizations, such as PMMA used as supporter material, are possible is formed in the perimeter of this rod. Then, the polymerization of the liquid solution in which a polymerization is possible is carried out. Subsequently, this disk that carried out the polymerization is cut down, cutting is performed, and an intraocular implant is created. Then, folding is made possible by carrying out hydration (water) of the lens.
[0012] The manufacture approach of an intraocular implant as shown below is indicated by JP,1-158949,A. That is, a plate etc. is created with the acrylic material constructed a bridge, the plate is put on an electrode holder, engine-lathe machining cuts on a disk at low temperature, and an elasticity optical department is obtained by cutting. A supporter hole is prepared in the obtained optical department, and a three-piece mold intraocular implant is obtained. Or from the plate which the above created, a lens configuration is started and an intraocular implant with the optical department and optical member which can fold, and the supporter of the elasticity nature which is this construction material is obtained.
[0013] Furthermore, the manufacture approach of an intraocular implant as shown below is indicated by JP,5-269191,A. That is, the polymerization of 5mmphi and the optical member with a height of 20mm is carried out, it installs in the center with a bore [of 15mm], and a height of 20mm of cylindrical after that, and the polymerization of the solution which serves as supporter material by the periphery is carried out. You create an intraocular implant configuration by cut after a polymerization, and make it immersed into alcohol for about 48 hours, and an optical department is made into elasticity by the esterification reaction.
[0014]
[Problem(s) to be Solved by the Invention] Although the manufacture approach of the above intraocular implants is indicated variously, these manufacture approaches have all bad production top effectiveness with complicated and complicated actuation.
[0015] That is, by the manufacture approach of the intraocular implant currently indicated by JP,62-142558,A and JP,62-152450,A, the synthetic-resin filament used as a supporter must be processed into a complicated configuration. A path is about 0.15mm and the filament used as a supporter must establish the process which requires very complicated and detailed processing for parts for all this end for processing the same configuration into thermofusion. A supporter needs to have the configuration for which it is suitable since it holds and fixes within an eye, and thermoforming etc. needs to create the configuration elaborately. That is, when this supporter created elaborately is surrounded and it manufactures an elasticity optical material within a mold, a supporter needs to pass through heating and an application-of-pressure process again, and may change the configuration of an intraocular implant, and a dimension.
[0016] Moreover, by the manufacture approach in JP,4-292609,A, the support filament insertion hole which cools an ingredient and intersects a supporter insertion hole and its hole needs two to be drilling operated, it must insert a supporter and a support filament in the hole, must attain by repeating a laser beam and irradiating restoration by the welding of a supporter, and the filament of a hole, and needs quite complicated actuation.
[0017] Moreover, in JP,4-295353,A, the raw material which uses HEMA as a principal component is used for the optical department, and at the time of the cut of a lens, although it is hard, it considers as

elasticity nature by carrying out hydration (water) after a cut. HEMA has a difference in water absorption in lot-to-lot. Therefore, in an intraocular implant, it is difficult to maintain fixed power. Furthermore, it will take time amount most for carrying out the water of the intraocular implant at the time of an operation. Moreover, when water is beforehand carried out to an intraocular implant, it becomes difficult to maintain the sterilization condition of an intraocular implant.
[0018] In JP,1-158949,A, since supporter construction material is the quality of an optical member, and this construction material, a supporter becomes elasticity. Since the diameter of a supporter of the conventional intraocular implant is about about 0.1-0.2mm, a supporter will become quite flexible. Therefore, maintenance of a supporter include angle is also difficult and it is thought that the location stability of the optical department within a sac is quite unstable.
[0019] Furthermore, in JP,5-269191,A, that in which supporter material has alcohol and reactivity cannot be used. Moreover, after carrying out the polymerization of an optical member and the supporter material, performing precise cut polish processing and creating an intraocular implant configuration, it is also difficult by adding a chemical reaction to an optical department for the configurations (change of curvature, thickness, diameter of optics, etc.) of an optical department to change, and to maintain the supporter include angle at the time of processing (angle type).
[0020] It is made in order that this invention may solve the above-mentioned trouble, and it is simple and aims at offering the manufacture approach of an one apparatus elasticity intraocular implant with sufficient production top effectiveness.
[0021]
[Means for Solving the Problem] Invention of claim 1 fixes to the position in an eye the optical department which functions as an alternative lens of a lens, and this optical department. It is the intraocular implant which consists of a supporter for holding, and the above-mentioned optical department is 5 - 20% of the weight of (1) type (the inside R1 of a formula) at least. the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 40 - 60% of the weight of (2) types (the inside R2 of a formula) the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 30 - 50% of the weight of (3) types (the inside R3 of a formula) R4 showing the substituent of a hydrogen atom or an alkyl group the substituent of the alkyl group of the straight chain whose carbon number is 12 or less [4 or more], or the letter of branching -- expressing -- it is characterized by consisting of a copolymer which makes a monomer 0.5 - 4% of the weight of a cross-linking compound to the AUW of the compound expressed and the compound expressed with (1) - (3) type.
[0022] Invention of claim 2 is characterized by the above-mentioned optical department having deformable elasticity at the time of insertion of the lens under ophthalmology operation in an intraocular implant according to claim 1.
[0023] Invention of claim 3 is characterized by joining the above-mentioned optical department and the above-mentioned above-mentioned supporter to one apparatus in the intraocular implant of elasticity according to claim 1 or 2.
[0024] Invention of claim 4 is characterized by joining the above-mentioned optical department and the above-mentioned above-mentioned supporter by the polymerization in the intraocular implant of one apparatus according to claim 3.
[0025] Invention of claim 5 fixes to the position in an eye the optical department which functions as an alternative lens of a lens, and this optical department. The process which carries out the polymerization of the raw material in which it is the manufacture approach of an intraocular implant which consists of a supporter for holding, and the above-mentioned supporter may be made to form, and in which a polymerization is possible, and forms the ingredient of the above-mentioned supporter, The process which makes a hole for the ingredient of this supporter that carried out the polymerization by machining, and the process which pours in the raw material which may make the above-mentioned optical department form in this hole, and in which a polymerization is possible, The polymerization of the poured-in raw material is carried out, and it is characterized by having the process which forms the one apparatus member of the above-mentioned optical department and the above-mentioned supporter, and the cut process which cuts this one apparatus member and the polish process to grind.
[0026] Invention of claim 6 fixes to the position in an eye the optical department which functions as

an alternative lens of a lens, and this optical department. Are the manufacture approach of an intraocular implant which consists of a supporter for holding, and where a cylindrical member is inserted in the core of the raw material in which a polymerization is possible in which the above-mentioned supporter may be made to form, the polymerization of the raw material concerned is carried out. The process which forms the ingredient of the above-mentioned supporter with which the hole opened by drawing out the above-mentioned cylindrical member after a polymerization, It is characterized by having the process which pours in the raw material which may make the above-mentioned optical department form in the hole of the ingredient of the above-mentioned supporter, and in which a polymerization is possible, the process which carries out the polymerization of the poured-in raw material, and forms the one apparatus member of the above-mentioned optical department and the above-mentioned supporter, and the cut process which cuts this one apparatus member and the polish process to grind.
[0027] Invention of claim 7 is set to the manufacture approach of an intraocular implant according to claim 5 or 6. The raw material in which the above-mentioned optical department may be made to form and in which a polymerization is possible is 5 - 20% of the weight of (1) type (the inside R1 of a formula) at least. the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 40 - 60% of the weight of (2) types (the inside R2 of a formula) the substituent of a hydrogen atom or an alkyl group -- expressing -- the compound expressed and 30 - 50% of the weight of (3) types (the inside R3 of a formula) R4 showing the substituent of a hydrogen atom or an alkyl group the substituent of the alkyl group of the straight chain whose carbon number is 12 or less [4 or more], or the letter of branching -- expressing -- it is characterized by including 0.5 - 4% of the weight of a cross-linking compound to the AUW of the compound expressed and the compound expressed with (1) - (3) type.
[0028] Invention of claim 8 is characterized by cutting a up Norikazu form member in the above-mentioned cut process of the manufacture approach of an intraocular implant given in any of claims 5-7 they are, cooling.
[0029] Invention of claim 9 is characterized by grinding a up Norikazu form member in the above-mentioned polish process of the manufacture approach of an intraocular implant given in any of claims 5-8 they are, cooling.
[0030] (1) The compound expressed with a formula is an important component for making the function which is made to reduce the surface adhesiveness of an intraocular implant ingredient, and is recovered and stabilized in the original configuration by moderate time amount (20-60s) at an intraocular implant add.
[0031] (2) The compound expressed with a formula is an indispensable component for giving a high refractive index to an intraocular implant ingredient.
[0032] (3) The compound expressed with a formula is an indispensable component for giving flexibility to an intraocular implant.
[0033] A cross-linking compound is an indispensable component for prevention of deformation of a lens and the improvement in a mechanical strength.
[0034] Moreover, by the manufacture approach of the intraocular implant of this invention, processes, such as hydration (water) or an esterification reaction, become unnecessary about an optical department by grinding an one apparatus member, cutting an one apparatus member and cooling cooling. Therefore, it also becomes possible to maintain a supporter include angle (angle type), and it becomes possible to obtain the intraocular implant which has the supporter which has reinforcement by hard.
[0035] Furthermore, it becomes possible by grinding an one apparatus member to manufacture an one apparatus elasticity intraocular implant by the same approach as the conventional one apparatus intraocular implant, cutting an one apparatus member and cooling cooling.
[0036]
[Embodiment of the Invention] Hereafter, the gestalt of operation of the intraocular implant by this invention and its manufacture approach is explained to a detail, referring to a drawing.
[0037] The intraocular implant concerning this invention consists of an optical department which functions as an alternative lens of a lens, and a supporter for fixing and holding this optical department to the position in an eye.

[0038] The description of this invention is in the place which carries out the polymerization of 0.5 - 4% of the weight of the cross-linking compound, and creates it to the AUW of the compound expressed with 5 - 20% of the weight of (1) type at least in this optical department, the compound expressed with 40 - 60% of the weight of (2) type, the compound expressed with 30 - 50% of the weight of (3) type, and the compound expressed with (1) - (3) type.
[0039] In addition, R1 in (1) type Which substituent of alkyl groups, such as a hydrogen atom or a methyl group, an ethyl group, butyl, and a propyl group, is expressed.
[0040] Moreover, R2 in (2) types Which substituent of alkyl groups, such as a hydrogen atom or a methyl group, an ethyl group, butyl, and a propyl group, is expressed.
[0041] Similarly, it is R3 in (3) types. Which substituent of alkyl groups, such as a hydrogen atom or a methyl group, an ethyl group, butyl, and a propyl group, is expressed, and it is R4. Carbon numbers, such as butyl and a pentyl radical, express or more 4 substituent of the alkyl group of the straight chain it is [straight chain] 12 or less, or the letter of branching.
[0042] In addition, in this invention, the polymerization nature coloring matter for coloring the compound and intraocular implant which have ultraviolet absorption ability in addition to the above-mentioned compound etc. can be used as a monomer concerning an optical department.
[0043] The polymerization of the compound and cross-linking compound which are expressed with such a (1) - (3) type is carried out, and how to manufacture an one apparatus elasticity intraocular implant is explained below.
[0044] First, let drawing 1 and the carbon button material of PMMA as shown in 2 be the ingredients of a supporter with the gestalt of this operation.
[0045] Drawing 1 is the side elevation of the carbon button which made the hole for elasticity optical department creation in PMMA material, and drawing 2 is this front view. The PMMA carbon button material 2 and 3 is 10mm in path 15mmphi and height, and the holes 1 and 4 for elasticity optical department creation are 4mm in path 7mmphi and depth.
[0046] Thus, the holes 1 and 4 for elasticity optical department creation are made in the carbon buttons 2 and 3 of the shape of a cylindrical shape of PMMA currently generally used to an intraocular implant at PMMA material.
[0047] These holes 1 and 4 are made to pour in and carry out the polymerization of 0.5 - 4% of the weight of the cross-linking compound at least to the AUW of the compound expressed with 5 - 20% of the weight of (1) type, the compound expressed with 40 - 60% of the weight of (2) type, the compound expressed with 30 - 50% of the weight of (3) type, and the compound expressed by (1) - (3) formula.
[0048] An optical department and a supporter create after a polymerization the intraocular implant which really (dress) made the configuration with a meaning machine, cutting a carbon button into 3mm and cooling.
[0049] Then, a desired one apparatus elasticity intraocular implant is created by carrying out barrel finishing to the bottom of low temperature, cooling.
[0050] (Example 1) The hole of 7mmphi was made in drawing 1 and the carbon button material of PMMA shown in 2, and the monomer of the combination shown below as an ingredient of an elasticity optical department was used.
[0051]
Weight section (% of the weight)
Phenylethyl methacrylate (PEMA) 49 n-butyl acrylate (BA) 42 Perphloro octyl ethyloxy Propylene methacrylate (BRM) 9 Ethylene glycol dimethacrylate (EDMA) 3 Azo-isobutyro-dinitrile (azobisuisobutironitoriru) The mixture of the 0.3 above was injected into the holes 1 and 4 of a carbon button, and the application-of-pressure polymerization was performed at nitrogen pressure 2.0 kg/cm2 and the temperature of 60 degrees C for 2 hours. after that 80degree-C- subsequently temperature up was carried out to 100 degrees C for 2 hours.
[0052] Thus, the carbon button which has the created elasticity optical member in the core of the PMMA carbon button is shown in drawing 3 and 4. Drawing 3 is the side elevation showing the carbon button which carried out in this way and was created, and drawing 4 is this front view.
[0053] Then, the optical surface was cut, blowing -5-degree C cold upon the carbon button which cut down and cut down the carbon button of 3mm thickness along the location 22 shown in the side

elevation of the carbon button of drawing 5 . Subsequently, blowing cold again, this cut-down carbon button was cut down for thick wire 14 part of drawing 6 with the meaning machine, and the one apparatus intraocular implant configuration was acquired.
[0054] the obtained lens -5-degree C constant temperature -- barrel finishing was performed for three days in the layer, and the one apparatus elasticity intraocular implant was obtained. Drawing 7 R> 7 is the front view showing the intraocular implant which carried out in this way and was created, and drawing 8 is this side elevation.
[0055] (Example 2) This example makes in carbon button material the hole of a configuration which is different in an example 1, and shows the example when manufacturing an intraocular implant using this carbon button.
[0056] The hole of 7mmphi was made in drawing 1 and the carbon button material of PMMA shown in 2, and the monomer same as an ingredient of an elasticity optical department as an example 1 was used.
[0057] First, in order to heat carbon button material within a 140-degree C press plate and to create the configuration of a hole, a jig is carried on a carbon button, and it is 4 kg/cm2. The load was added and the carbon button was pressed.
[0058] thus, the created carbon button -- drawing 9 -- it is shown ten. Drawing 9 is the side elevation showing the carbon button which carried out in this way and was created, and drawing 10 is this front view. The carbon button material 22 and 23 is 10mm in path 15mmphi and height, and holes 21 and 24 are 4mm in path 7mmphi and depth.
[0059] The mixture of the same presentation as an example 1 was poured in to the created holes 21 and 24, and the polymerization was performed on an example 1 and these conditions (the application-of-pressure polymerization was performed at nitrogen pressure 2.0 kg/cm2 and the temperature of 60 degrees C for 2 hours.). after that 80degree-C- subsequently temperature up was carried out to 100 degrees C for 2 hours. The one apparatus elasticity intraocular implant was obtained by performing the still more nearly same cut / polish processing as an example 1.
[0060] The description of the drawing 9 and the carbon button of 10 which were used for this example is in the place which has prepared the projected part in holes 21 and 24. Reinforcement can be given to a part for the joint of an optical department and a supporter by making the holes 21 and 24 which have this projected part pour in and carry out the polymerization of the mixture of a monomer, and clipping an one apparatus intraocular implant with a meaning machine so that the thick wire 27 of drawing 11 may show.
[0061] The intraocular implant obtained by this example is shown in drawing 12 and 13. Drawing 12 is the front view showing the created intraocular implant, and drawing 13 is this side elevation.
[0062] (Example 1 of a comparison) This example of a comparison is an example when performing the same processing as an example 1, and creating an one apparatus intraocular implant except only cooling having become, when performing cut of an optical surface, and logging with a meaning machine.
[0063] The hole of 7mmphi was made in drawing 1 and the carbon button material of PMMA shown in 2, ******** of the presentation same as an ingredient of an elasticity optical department as an example 1 was injected into the holes 1 and 4 of a carbon button, and the application-of-pressure polymerization was performed at nitrogen pressure 2.0 kg/cm2 and the temperature of 60 degrees C for 2 hours. after that 80degree-C- subsequently temperature up was carried out to 100 degrees C for 2 hours.
[0064] Then, the carbon button of 3mm thickness was cut down and the optical surface was cut, without cooling. Subsequently, without cooling, this cut-down carbon button was cut down with the meaning machine, and the one apparatus intraocular implant configuration was acquired.
[0065] the obtained lens -5-degree C constant temperature -- barrel finishing was performed for three days in the layer, and the one apparatus elasticity intraocular implant was obtained.
[0066] Thus, an elasticity optical surface milks the obtained one apparatus elasticity intraocular implant, and it does not have an optical function.
[0067] (Example 2 of a comparison) This example of a comparison performs shaping according carbon button material to a press like an example 2, and are drawing 9 and an example at the time of making holes 21 and 24 so that it may be shown ten, pouring in and carrying out the polymerization

of the HEMA to these holes 21 and 24, and performing wet treatment.
[0068] First, in order to heat carbon button material within a 140-degree C press plate and to create the configuration of a hole, a jig is carried on a carbon button, and it is 4 kg/cm2. The load was added and the carbon button was pressed.
[0069] HEMA was poured in to the created holes 21 and 24, and the polymerization was performed.
[0070] Then, the carbon button was cut down and the optical surface was cut, without cooling. Subsequently, without cooling, this cut-down carbon button was cut down with the meaning machine, and the one apparatus intraocular implant configuration was acquired. In this example of a comparison, in order to perform wet treatment so that it may mention later, it did not cool. Subsequently, barrel finishing was performed on the obtained lens for three days, and the one apparatus intraocular implant was obtained. The supporter include angle of the one apparatus intraocular implant created at this time was 10 degrees.
[0071] Furthermore, the water of the optical department part was carried out by making the obtained intraocular implant immersed into distilled water for three days. The supporter include angle of the one apparatus intraocular implant after water is about 5-6 degrees, and was changing from the thing in front of water considerably.
[0072] The bonding strength of an optical department and a supporter was pulled and the trial compared the intraocular implant created in the above examples 1 and 2 and the examples 1 and 2 of a comparison. The test result is shown below.
[0073]

	引っ張り強度（g）
実施例１	約１４０
実施例２	約１７０
比較例１	約３０
比較例２	約５５

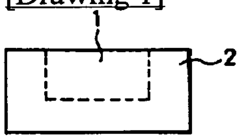
This invention is not limited to the thing of the gestalt of the above-mentioned operation, and permits various deformation.
[0074] In addition, by the manufacture approach of the intraocular implant of this invention, the configuration of drawing 14 and a hole as shown in 15 is sufficient as the configuration of a hole, and the configuration of other holes which are not illustrated is sufficient as it. Moreover, you may make it make a carbon button penetrate in various configurations. Similarly, the path of a hole may also be set to arbitration. Drawing 14 is the side elevation showing one example of a carbon button which made the hole for elasticity optical department creation in PMMA material, and drawing 15 is this front view. The PMMA carbon button material 35 and 38 is 10mm in path 15mmphi and height, and the hole 37 for elasticity optical department creation is 4mm in path 7mmphi and depth.
[0075] Although the hole of a carbon button can be made with a milling cutter plate etc., a configuration with a more complicated hole [make / create the jig of the configuration of a hole to make and / with a press machine / a hole] can also be created easily. Moreover, tensile strength can increase the reinforcement of the part used as increase and a supporter by carbon button material being pressed (drawing).
[0076] Moreover, when carrying out the polymerization of the carbon button from a raw material, the Teflon rod etc. is inserted in the core of a raw material, and the carbon button with which the Teflon rod etc. was drawn out after polymerization termination, and the hole opened in the core may be created.
[0077] Moreover, acrylic resin, such as a copolymer of methyl methacrylate and methyl methacrylate, ethyl methacrylate, and butyl methacrylate, and they were colored the carbon button material concerning this invention, and a thing activity can be carried out at it.
[0078] Furthermore, the thing except having been shown in the example is sufficient as the ingredient of the optical department concerning this invention, and a supporter, it is the thing of low water content (a cut is possible, cooling), and by the polymerization, as long as an optical department and a supporter are combinable, other construction material may be used for it.
[0079]
[Effect of the Invention] The compound which is expressed with 5 - 20% of the weight of (1) type at

least according to this invention as explained above, The compound expressed with 40 - 60% of the weight of (2) types, and the compound expressed with 30 - 50% of the weight of a formula, (1) Since the construction material of an optical department was created by carrying out the polymerization of 0.5 - 4% of the weight of the cross-linking compound to the AUW of the compound expressed with - (3) type The need of establishing the process of water or an esterification reaction after intraocular implant processing can be lost, and ************ can be manufactured with simple and sufficient production top effectiveness.

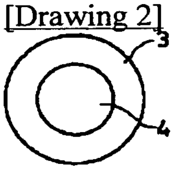
[Translation done.]

DRAWINGS

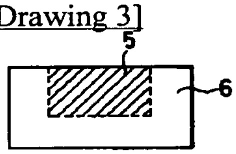
[Drawing 1]



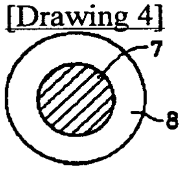
[Drawing 2]



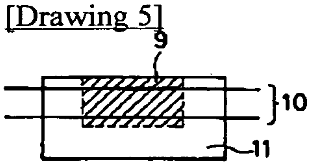
[Drawing 3]



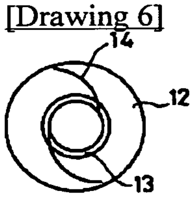
[Drawing 4]



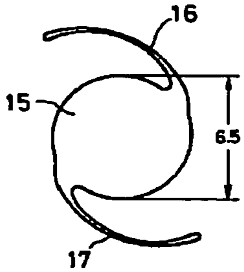
[Drawing 5]



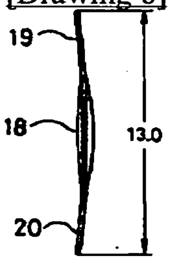
[Drawing 6]



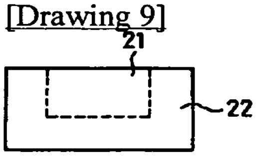
[Drawing 7]



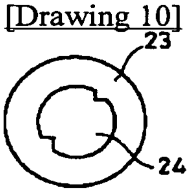
[Drawing 8]



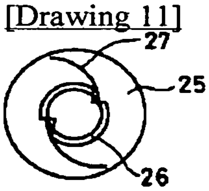
[Drawing 9]



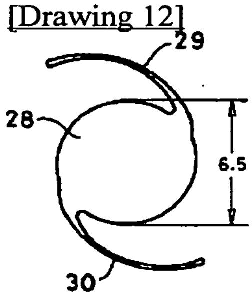
[Drawing 10]



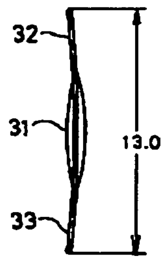
[Drawing 11]



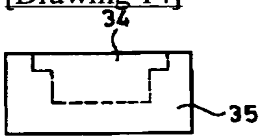
[Drawing 12]



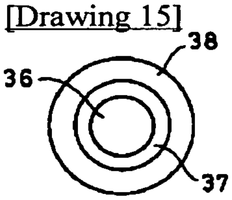
[Drawing 13]



[Drawing 14]



[Drawing 15]



[Translation done.]